

WHAT IS CLAIMED IS:

1. An optical switching equipment for switching a route of an optical signal received from any one of a plurality of optical transmission routes and outputting said optical signal to any one of a plurality of optical transmission routes, comprising:

first interfaces for transmitting or receiving the optical signals to or from another switching equipment through a plurality of first optical transmission routes;

second interfaces for transmitting or receiving the optical signals to or from a communicating equipment connected to said optical switching equipment through a plurality of second optical transmission routes;

optical switches for providing a route of said optical signal between said plurality of first interfaces or between said plurality of first interfaces and said plurality of second interfaces; and

a control circuit for setting a route of said optical signal inside said optical switch;

wherein the optical signal received from said second optical transmission route is split into a plurality of optical signals, and said plurality of optical signals is outputted to said plurality of first different optical transmission routes through a plurality of routes set in said optical switch; and

as to the optical signal to be outputted to

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said second optical transmission route, when said plurality of routes are set in said optical switches and a plurality of optical signals are received from said plurality of first different optical transmission routes, one of said optical signals is selectively outputted to said second optical transmission route.

2. An optical switching equipment for switching a route of an optical signal received from any one of a plurality of optical transmission routes and outputting said signal to any one of a plurality of optical transmission routes, comprising:

    a plurality of optical receivers for receiving optical signals from a plurality of first optical transmission routes;

    a plurality of optical distributors for receiving optical signals from a plurality of second optical transmission routes and distributing said received signals as a plurality of optical signals;

    optical switches provided with a plurality of input and output terminals respectively and for switchably outputting the optical signals received from said optical receiver and said optical distributor at any one of said plurality of input terminals to any one of said plurality of output terminals;

    a plurality of optical transmitters for outputting the optical signals from the output terminal of said optical switch to the first optical transmission routes corresponding to said output

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terminals;

a plurality of optical selectors for receiving a plurality of optical signals from the plurality of output terminals of said optical switch, selecting any one of said plurality of optical signals, and outputting said selected signal to the second optical transmission route corresponding to said plurality of output terminals; and

a control circuit for setting a route of the optical signal in said optical switch;

wherein the optical signal received from said second optical transmission route is split into a plurality of optical signals through the effect of said optical distributor and said plurality of optical signals are outputted to the corresponding first different optical transmission routes through a plurality of routes set in said optical switch, and

as to the optical signal to be outputted to said second optical transmission route, when a plurality of routes are set to said optical switch and the plurality of optical signals are received from said plurality of first different optical transmission routes, said optical selector selects one of said plurality of optical signals and then outputs it to said second optical transmission route.

3. An optical switching equipment as claimed in claim 1, wherein when the output destination of the optical signal received from any one of said plurality

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of first transmission routes corresponds to any one of said plurality of first optical transmission routes, the route corresponding to the first optical transmission route where said optical signal is to be outputted is set to said optical switches and the optical signal is outputted thereto.

4. An optical switching equipment as claimed in claim 2, wherein when the output destination of the optical signal received from any one of said plurality of first transmission routes corresponds to any one of said plurality of first optical transmission routes, the route corresponding to the first optical transmission route where said optical signal is to be outputted is set to said optical switches and the optical signal is outputted thereto.

5. An optical switching equipment as claimed in claim 1, wherein said optical switch is composed of a plurality of optical switches and the optical signal received from said second optical transmission route and the optical signal to be outputted to said second optical transmission route are routed to the different optical switches so as to output the optical signals to the predetermined first different optical transmission routes and receive the optical signals from the predetermined first different optical transmission routes.

6. An optical switching equipment as claimed in claim 2, wherein said optical switch is composed of a

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plurality of optical switches, and the optical signal received from said second optical transmission route and the optical signal to be outputted to said second optical transmission route are routed to the different optical switches so as to output the optical signals to the predetermined first different optical transmission routes and receive the optical signals from the predetermined first different optical transmission routes.

7. An optical switching equipment as claimed in claim 5, wherein when the output destination of the optical signal received from any one of said plurality of first transmission routes corresponds to any one of said plurality of first optical transmission routes, the route corresponding to the first optical transmission route where said optical signal is to be outputted is set to any one of said optical switches and said optical signal is outputted thereto.

8. An optical switching equipment as claimed in claim 6, wherein when the output destination of the optical signal received from any one of said plurality of first transmission routes corresponds to any one of said plurality of first optical transmission routes, the route corresponding to the first optical transmission route where said optical signal is to be outputted is set to any one of said optical switches and said optical signal is outputted thereto.

9. A method of using an optical switching

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equipment for switching a route of an optical signal received from any one of a plurality of first and second optical transmission routes and outputting the optical signal to any one of said plurality of first or second optical transmission route, comprising the steps of:

splitting the optical signal received from any one of said second optical transmission route into a plurality of optical signals and then outputting said optical signals to the different first optical transmission routes, respectively; and

as to the output signal to be outputted from any one of said plurality of first optical transmission routes to said plurality of second optical transmission routes, receiving a plurality of optical signals from said plurality of first different optical transmission routes, selecting any one of said plurality of received optical signals, and outputting said selected optical signal to said second optical transmission route.

10. A method of operating an optical transport network having a plurality of optical switching equipments provided with optical switches, for transmitting or receiving optical signals between said optical switching equipments, comprising the steps of:

in the case of adding the optical signal of each of said optical switching equipments from said optical transmission route to said optical transport network, splitting said optical signal into a plurality

of optical signals, and outputting each of said optical signals from a plurality of different optical transmission routes to the other plurality of different optical transmission routes through a plurality of routes set in said optical switches;

in the case of transiting the optical signals from each of said optical switching equipments to each of the other optical switching equipments, outputting the optical signals received from said optical transmission routes from said optical transmission routes to the other optical switching equipment through the routes set in said optical switches; and

in the case of dropping the optical signal for each of said optical switching equipment from said optical transport network into said optical transmission path, setting a plurality of routes to said optical switches, and when receiving a plurality of optical signals from said plurality of different optical switching equipments through the plurality of different optical transmission routes, selecting one of said plurality of optical signals.

11. A method of operating an optical transport network having a plurality of optical switching equipments provided with optical switches, for transmitting or receiving optical signals between said optical switching equipments, comprising the steps of:

in the case of adding the optical signal of the first optical switching equipment into the second

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optical switching equipment, splitting said optical signal received from said optical transmission route into a plurality of optical signals, and outputting said plurality of optical signals from a plurality of different optical transmission routes to a plurality of different third optical switching equipments through a plurality of routes set in said optical switches;

causing each of said plurality of third optical switching equipments to output the optical signal, received from said first optical switching equipment or another third optical switching equipment through said optical transmission route, from said optical transmission route to said second optical switching equipment to another third optical switching equipment through said routes set to said optical switches; and

in the case of dropping the optical signal for said second optical switching equipment from said optical transport network to said optical transmission route, setting a plurality of routes to said optical switches, when a plurality of optical signals are received from said plurality of different third optical switching equipments through a plurality of different optical transmission routes, selecting any one of said plurality of optical signals.

12. An optical transport network having a plurality of optical switching equipments connected with a plurality of optical transmission routes and for

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transmitting or receiving optical signals between said optical switching equipments, comprising:

    said optical switching equipments, each of which includes;

        first interfaces for transmitting or receiving the optical signals to or from another optical switching equipment through a plurality of first optical transmission routes,

        second interfaces for transmitting or receiving the optical signals to or from a communicating equipment connected with said optical switching equipment through a plurality of second optical transmission routes,

        optical switches for supplying routes of the optical signals between said plurality of first interfaces or between said plurality of first interface and said plurality of second interfaces, and

        a control circuit for setting the routes of the optical signals inside said optical switches;

    wherein in the case of adding the optical signal received from said second optical transmission route into said optical transport network, each of said optical switching equipments operates to split said received optical signal into a plurality of optical signals and output said plurality of optical signals from a plurality of routes set in said optical switches to another plurality of different optical switching equipments through said plurality of first different

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optical transmission routes, respectively;

as to the optical signal to be dropped from said optical transport network to said second optical transmission route, when a plurality of optical signals are received through said plurality of first different optical transmission routes from another plurality of different optical switching equipments respectively by setting a plurality of routes in said optical switch, selecting one of said plurality of optical signals and outputting said signal to said second optical transmission route; and

in the case of relaying the optical signal inside said optical transport network, outputting the optical signal received from any one of said plurality of first transmission routes to the destination first optical transmission route through the routes set in said optical switches.

13. A method of using an optical transport network having a plurality of optical switching equipments provided with optical switches, said optical switching equipments being connected through a plurality of optical transmission routes and for transferring optical signals between said optical switching equipments, comprising the steps of:

in said optical switching equipment for adding the own optical signal into said transport network, splitting said optical signal into a plurality of optical signals and setting a plurality of routes in

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said optical switches so as to output said optical signals to another plurality of different optical switching equipments through a plurality of different optical transmission routes;

in said plurality of optical switching equipments for relaying the optical signals received in said optical transport network to another optical switching equipment, setting the routes of said optical switches so as to output the optical signal received from any one of said optical transmission routes to said another optical switching equipment corresponding to the destination of said optical signal through said optical transmission routes; and

in said optical switching equipment for dropping the optical signal from said optical transport network, when receiving a plurality of optical signals from said plurality of different optical switching equipments through said plurality of different optical transmission routes, setting the routes in said optical switches so that any one of said plurality of optical signals is selected and then is outputted.

14. A method of using an optical transport network having a plurality of optical switching equipments provided with optical switches, said optical switching equipments being connected through a plurality of optical transmission routes, for transferring optical signals between said optical switching equipments, comprising the steps of:

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in the first optical switching equipment, splitting the optical signal to be sent to a second optical switching equipment into a plurality of optical signals, setting a plurality of routes in said optical switches in a manner to output said plurality of optical signals from the plurality of different optical transmission routes to a plurality of different optical switching equipments to add the signals to the network, respectively;

in each of said plurality of third optical switching equipments, setting the routes in said optical switches in a manner to relay the optical signals received from said first optical switching equipment or another third optical switching equipment to said second optical switching equipment or another third optical switching equipment; and

in said second optical switching equipment, when the optical signals are received from said plurality of different third optical switching equipments through a plurality of different optical transmission routes, setting the routes in said optical switches so as to select one of said optical signals and drop said optical signal from said optical transport network.

15. An optical switching equipment for switching a route of an optical signal received from any one of a plurality of optical transmission routes and then outputting said optical signal to any one of said

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optical transmission routes, comprising:

a plurality of optical receivers for receiving the optical signals from said plurality of first optical transmission routes;

a plurality of optical distributors for receiving the optical signals from said plurality of second optical transmission routes and distributing said received signal as a plurality of optical signals;

optical switches provided with a plurality of input and output terminals respectively and for switching the optical signal received at any one of said input terminals from said optical receiver and said optical distributor into any one of said output terminals and then outputting said optical signal thereto;

a plurality of optical transmitters for outputting the optical signals at the output terminal of said optical switch to the first optical transmission routes corresponding to said output terminals;

a plurality of optical switches for receiving a plurality of optical signals from a plurality of output terminals of said optical switch, selecting any one of said plurality of optical signals, and outputting said selected signal to the second optical transmission routes corresponding to said output terminals; and

a control circuit for setting the route of

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the optical signal inside said optical switch.

16. An optical switching equipment for switching the route of an optical signal received from any one of a plurality of optical transmission routes and then outputting said optical signal to any one of a plurality of optical transmission routes, comprising:

    a plurality of optical receivers for receiving a wavelength-multiplexed optical signals from a plurality of first optical transmission routes;

    a plurality of optical demultiplexers for demultiplexing said wavelength-multiplexed optical signal into respective frequency signals;

    a plurality of first optical signal adjusters for converting the frequency of and adjusting the level of the optical signal outputted from each of said optical demultiplexers;

    a plurality of optical distributors for receiving the optical signals from a plurality of second optical transmission routes and distributing said received signal as a plurality of optical signals;

    optical switches provided with a plurality of input and output terminals respectively and for switching the optical signals of said optical signal adjuster and said optical distributor received at any one of said input terminals into any one of said output terminals and then outputting said signals thereto;

    a plurality of second optical signal adjusters for converting the frequency and adjusting

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the level of the optical signal outputted from said optical switch;

a plurality of optical multiplexers for multiplexing the outputs of said plurality of second optical signal adjusters into the wavelength-multiplexed optical signal;

a plurality of optical transmitter for outputting the wavelength-multiplexed optical signal from said optical multiplexer to the first optical transmission route;

a plurality of optical switchers for receiving a plurality of optical signals from the outputs of said plurality of second optical signal adjusters, selecting any one of said optical signals, and outputting said selected signal to said second optical transmission route; and

a control circuit for setting the routes of the optical signals in said optical switches.

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